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OPERATING EXPERIENCE WEEKLY SUMMARY

Office of Nuclear and Facility Safety

March 6 through March 12, 1998

Summary 98-10

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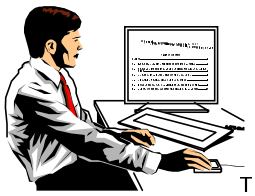

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EVENTS

1. CONTAMINATED LIQUID SPRAYS FROM PIPING SYSTEM DURING FLANGE REMOVAL

On March 3, 1998, at the Oak Ridge Environmental Restoration Facility, an operator was removing a blank flange from an isolated low-level liquid waste transfer line to add a termination box and contaminated liquid sprayed from the flange. A pre-positioned plastic tarp protected the operator from the spray. The operator re-tightened the bolts on the flange and stopped the release. No personnel were contaminated, but the internal surface of the concrete containment basin, a valve box, and a 1-square-foot area outside the basin indicated contamination levels of 14 mrad/hr beta-gamma and 65,000 dpm/100 cm^2 alpha. The flanged section of piping was isolated by a lockout/tagout. However, the isolation boundary valve leaked, and contaminated liquid accumulated during previous system transfers. The liquid was pressurized by the elevation head of the connected piping upstream of the valve. Supervisors had anticipated the potential for residual liquid, but did not completely plan for the pressurization of the liquid at the piping low point. Engineered methods, such as installing a hot-tap with a petcock, could have been used to drain the liquid from the pipe in a controlled manner to prevent the spread of contamination. (ORPS Report ORO--LMES-X10ENVRES-1998-0002)

Operators were attempting to connect a termination box for a secondary containment transfer line to an active line that was installed in 1996 to transfer liquid waste from tanks at the Old Hydrofracture Facility to the low-level liquid waste storage tanks. The line the operators accessed had never been used. Although work planners expected no radioactive contamination in the line, they recognized the potential for contamination under pressure, and operators used a spill kit, a bucket under the flange, and a plastic tarp for shielding. After the leak occurred, radiological control technicians placed absorbent pads on the plastic under the flange to capture the waste water. They also roped the area off and posted it as a contamination area. The technicians surveyed all personnel exiting the area and detected no personnel contamination.

Investigators determined that a supervisor stated that the isolation valve could leak because the valve seats were malleable. They also determined that planners believed that as long as no waste transfers were in progress there would be no buildup of pressure. However, if the work planners and supervisors had checked the piping arrangement, they would have recognized that the low point could be affected by a piping elevation of 5 to 10 feet and been alerted to the potential for pressurization downstream of the leaking isolation valve.

NFS has reported numerous events in the Weekly Summary where contaminated or hazardous solutions sprayed or leaked from piping systems. Following are some examples.

- Weekly Summary 97-49 reported that a Savannah River Site operator was sprayed with low-level radioactive sludge from a flange at a pressure indicator while repositioning valves for the indicator following removal of a lockout/tagout. Mechanics had removed the pressure indicator from the piping system to calibrate it, but failed to properly align the flanges when they reinstalled it. They also did not perform a leak-check of the system. The operator did not realize that the flanges were not tight. When he opened the discharge isolation valve (isolation boundary), the elevation of the piping system allowed the sludge to flow back down the line to the pressure indicator. (ORPS Report SR--WSRC-RMAT-1997-0011)

- Weekly Summary 96-18 reported that two pipefitters at the Savannah River Site were splattered with a 50-percent sodium hydroxide solution when cutting a transfer line from a tank. When the pipefitters made a cut in the pipe near a low point that was hidden by lagging, the sodium hydroxide spilled out causing minor skin irritation. The 30-foot-long pipe had a 3-inch dip near the middle that provided an area for solution to accumulate. Operators had drained and flushed the tank, but were unable to flush the transfer line. Although the Operations coordinator informed construction managers of these actions, the managers failed to inform the pipefitters. The event resulted from poor communication between Operations and the Construction personnel, the industrial hygienists, and the work planners regarding the status of the transfer line. Investigators determined that supervisors did not identify the potential for residual solution in the line and did not discuss the hazards of caustic solutions. (ORPS Report SR--WSRC-FCAN-1996-0006)

These events illustrate the importance of exercising caution when working with potentially pressurized systems. Contamination or injury can result even if protective equipment is worn. Workers and job planners should be trained to recognize conditions where residual pressure may exist. Recommended precautions when opening systems under such conditions include using additional shielding, such as a glove bag, and keeping personnel out of the path of potential discharges. The use of hot-taps for vent and drain paths can be helpful in venting and draining piping systems. Also work planners should review as-built drawings, consult with systems experts (such as operators), and walk-down the system to observe its configuration in order to determine potential work hazards.

KEYWORDS: contamination, leakage, pressurized, pipe, radiation protection, work planning

FUNCTIONAL AREAS: Mechanical Maintenance, Radiation Protection, Work Planning

2. AUTHORIZATION BASIS VIOLATION BECAUSE OF SHIFT TURNOVER ERROR

On March 3, 1998, at the Pantex Plant, a plant shift superintendent discovered that a shift turnover error allowed an on-coming shift facility manager to authorize operations in a building cell that was in a maintenance mode from the previous shift. The facility authorization basis prohibits operations while in maintenance mode because critical safety systems may not be operable. Investigators determined that the off-going facility manager reported the cell as being in maintenance mode to personnel in the Operations Center. However, they mistakenly marked a facility transfer sheet (used to inform on-coming facility managers of facility status) to indicate that the cell was in operation. When the error was discovered by the Operations Center personnel, the on-coming facility manager was informed, and he suspended operations in the cell; returned it to the maintenance mode; and investigated the discrepancy. He confirmed that the facility had not been formally placed in the operation mode before personnel performed operations. Although production technicians had performed a pre-operational checklist and verified that all critical safety systems were functional at the time of the event, the turnover resulted in a violation of the authorization basis. (ORPS Report ALO-AO-MHSM-PANTEX-1998-0012)

The off-going shift facility manager placed the cell in the maintenance mode during his shift to allow preventive maintenance work on a high-efficiency particulate air filter. Maintenance personnel completed the filter work during that shift, but did not formally return the cell to the operation mode. The on-coming facility manager received incorrect information about the status of the cell from the facility transfer sheet, and when the operations manager requested permission to commence operations in the cell, he granted it. Because the operations manager assumed the facility manager knew the correct status of the cell, he did not mention that he found the cell in the maintenance mode. The operations manager verified that technicians had performed the pre-operational check, then changed the sign at the cell from maintenance mode to operation mode.

The facility manager conducted a critique of the event on March 4. The present system for shift turnover relies on the accuracy of the facility transfer sheet from the Operations Center. Facility status is not a specific turnover item between the off-going and the on-coming facility managers, which establishes a condition for single-point failure.

NFS has reported several inadequate shift turnover events in the Weekly Summary. Following are some examples.

- Weekly Summary 97-52 reported that a shift facility supervisor at the Idaho National Engineering Laboratory failed to notify the on-coming shift that the laboratory was in repair-mode status because of an inoperable radiation stack monitor. The on-coming shift facility supervisor made a log entry that the laboratory was in an operational mode. Investigators determined that an incomplete shift turnover led to the violation of the facility limiting condition for operation. (ORPS Report ID--LITC-SMC-1997-0002)

- Weekly Summary 97-31 reported that an operator at the Savannah River Site incorrectly determined that a tank inlet valve was closed when it was actually open and allowed acid to transfer to a tank that was supposed to be isolated. The operator presumed the valve was closed based on the previous shift's operation of the system. Investigators determined that the shift turnover was inadequate and there were no log entries indicating the actual system lineup. (ORPS Report SR--WSRC-HCAN-1997-0031)

- Weekly Summary 96-36 reported that operators at the Savannah River Site operated a facility after the time limit for a limiting condition for operation had expired. Maintenance technicians were repairing facility exhaust fans and caused the ventilation system to be inoperable. The limiting condition for operation required the operators to place the facility in warm standby. The following day, the shift operations manager realized that the limiting conditions for operation time limit had expired and immediately placed the facility in warm standby. He was not previously aware of the limiting conditions for operation time limit because of an inadequate shift turnover. (ORPS Report SR--WSRC-HBLINE-1996-0017)

These events illustrate the need for personnel to be aware of and communicate any action, operation, or equipment status that has the potential to impact an on-coming shift. Conduct of operations principles (such as complete and thorough communications and the need to satisfy all the requirements of the shift turnover process) are principal components for efficient, effective, and safe operations. In addition, managers are responsible for ensuring that policies are adequately defined and adhered to, both to prevent events from occurring and to enhance the safety of personnel, equipment, and the environment. Although the Pantex event was administrative, in that the modes were not formally changed, operation within a facility without the availability of critical safety systems (e.g., filters, radiation monitors, fire protection) could place facility personnel and the public at risk during an accident.

Facility managers should review the following documents to ensure that (1) personnel understand their shift turnover responsibilities and (2) management policies and procedures address proper shift turnover.

DOE O 5480.19, *Conduct of Operations Requirements for DOE Facilities*, chapter II, "Shift Routines and Operating Practices," states that the on-duty shift supervisor maintains authority and responsibility for all facility operations. Chapter XI, "Logkeeping," provides guidelines on establishing operating logs, recording information, ensuring legibility of entries, and performing reviews of logs. Chapter XII, "Operations Turnover," states that shift turnover is a critical part of DOE facility operations. The Order also states that on-coming personnel should not assume operational duties until both they and the off-going personnel have a high degree of confidence that an appropriate information transfer has taken place. On-coming personnel should conduct a comprehensive review of appropriate written (logs, records) and visual (equipment, control boards) information before responsibility for the shift is transferred. Shift turnovers should be guided by a checklist and should include a thorough review of appropriate documents describing important aspects of facility status and an inspection of appropriate facility instrumentation.

DOE-STD 1038-93, *Guide to Good Practices for Operations Turnover*, states that operations turnover practices are one element of an effective conduct of operations program and that effective turnovers are crucial to the safety of DOE facilities. The turnover process should ensure that on-coming personnel have an accurate picture of facility status and that past and scheduled operations are reviewed. Briefings conducted near the end of each shift enhance shift turnover and operator awareness of plant status and identify needed follow-up actions. As a result, operators involved are informed and prepared to conduct a more thorough shift turnover to on-coming personnel.

DOE-STD-1031-92, *Guide to Good Practices for Communications*, discusses the need for clear, formal, and disciplined communications and provides guides to improve communications.

KEYWORDS: communication, conduct of operations, operations and maintenance,

FUNCTIONAL AREAS: Operations

3. RADIOLOGICALLY CONTAMINATED WATER SPILLED

On March 1, 1998, at the Idaho National Engineering and Environmental Laboratory, operators estimated that 50 gallons of water containing depleted uranium oxide spilled onto the floor of a building that houses the non-acidic evaporator. Investigators determined that the spill occurred because the steam supply providing heat to the evaporator failed while feedwater continued to

enter the evaporator. Designers did not equip the evaporator system with alarms or interlocks that would mitigate the effects of loss of steam to the evaporator. Operators isolated the area of the spill and cleaned the area, but they did not promptly notify radiological control technicians, in violation of the site radiation control manual. Design deficiencies contributed to the loss of control of radioactive material. (ORPS Report ID--LITC-SMC-1998-0001)

Feedwater containing depleted uranium oxides and other non-radiological solids is fed into the evaporator at a rate of approximately 1 gallon per minute. The water flashes to steam, and the remaining oxides adhere to the inner walls of the evaporator. Rotating mechanical scrapers remove the solids, which fall to the funnel-shaped bottom of the evaporator. The dry oxides and other solids then fall out through a small opening into a 55-gallon drum. When the operator noticed that the steam supply to the evaporator was lost, he isolated the feedwater to the evaporator. However, the opening was already plugged with wet solids that allowed water to accumulate in the bottom of the evaporator. Before the operator could siphon the water to an approved drain, the plug dislodged, and water and solids flowed into the drum and overflowed onto the floor.

Investigators determined that feedwater containing depleted uranium oxide and other solids continued to enter the evaporator for an undetermined period of time after the condensate return pumps tripped. The trip of the return pumps resulted in the loss of steam to the evaporator. They also determined that procedures required operators to monitor steam pressure to the evaporator steam jacket every 2 hours. Facility managers plan corrective actions that include installing an annunciator to warn of falling steam-supply pressure and providing refresher training for operators on proper response to radiological spills. The cause of the condensate pumps tripping is being investigated.

NFS has reported other events involving less-than-adequate design review in the Weekly Summary. Following are some examples.

- Weekly Summary 97-35 reported a deficiency in the application of a hydrogen sensor at the Hanford Tank Farms. The sensor was not installed in a climate-controlled enclosure. The manufacturer's specifications for the sensor required operating temperatures of 70 to 120 degrees Fahrenheit. Investigators determined that inadequate system design and design reviews resulted in the installation of equipment that could not reliably perform its safety function at low ambient temperatures. (ORPS Report RL--PHMC-TANKFARM-1996-0025)

- Weekly Summary 95-19 reported that radioactive contamination was released at the Brookhaven National Laboratory when a beam target broke during a high-intensity experiment. Four experimenters received internal exposures. Investigators determined the design review associated with the experiment was inadequate. (ORPS Final Report CH-BH-BNL-AGS-1995-0002)

- Weekly Summary 94-11 reported that the removal of a barrier wall at the Savannah River Site caused an air reversal in a building that allowed air flow from a radiological control area to a control room and offices. Investigators determined that engineers should have identified the impact removing the wall would have on ventilation system operation during their design review process. (ORPS Report SR--WSRC-HCAN-1994-0033)

This event underscores the importance of engineers and system experts conducting thorough reviews of system designs. DOE 5700.6C, *Quality Assurance*, specifies criteria for inspection and acceptance testing. The inspection and acceptance testing criteria state that a process should be established and implemented to specify when to inspect or test items and what type of inspection or test is required.

This event also underscores the importance of proper operator response to radiological spills. DOE-EH-0256T, *Radiological Control Manual*, establishes practices for the conduct of DOE radiological control activities. This document states that it is a worker's responsibility to minimize the spread of potential radioactive spills and to promptly notify the appropriate personnel of all spills. DOE 5400.5*, Radiation Protection of the Public and the Environment*, provides reference values for exposure limits to radionuclides when conducting radiological environmental protection programs at DOE facilities.

KEYWORDS: design deficiency, training program

FUNCTIONAL AREAS: Design, Training and Qualifications

4. LESSONS LEARNED HELP WORKERS RESPOND TO PRESSURIZED DRUMS

On February 24, 1998, at the Idaho National Engineering and Environmental Laboratory, an inspector found two bulging drums stored in a locked RCRA-compliant portable storage unit. The storage unit is temperature-controlled and designed to contain any solid or liquid release. Investigators believe the effect of anaerobiosis on septic wastes stored in the drums generated gasses and pressurized the drums. Inspectors recognized the hazards presented by pressurized drums and took appropriate actions to mitigate these hazards. Inspectors monitored the drums daily until pressure was safely released on March 2, 1998. There was no evidence drum leakage. This event is significant because pressurized drums have the potential to cause personal injury from the sudden release of pressure, expose personnel to contamination, or release hazardous or toxic drum contents to the environment. (ORPS Report ID—LITC-CFA-1998-0002)

Investigators reported that a worker dressed in personal protective equipment, including a respirator, vented both drums by placing a specially-designed net over the drums, loosening the lid ring bolts, and tapping the lids until gas could be heard escaping. Other workers monitored the atmosphere inside the portable storage unit for flammable gasses after the drums were vented and determined that levels were well below the flammable limit. Event response planners based their drum-venting procedures on lessons learned from occurrence report number ID--LITC-WROC-1996-0003 (reported in Weekly Summary 96-44) and from DOE Lesson Learned L-1996-OR-LMESPADER-1101, available at the DOE Lessons Learned Home Page URL http://tis.eh.doe.gov:80/others/ll/ll.html. The lessons learned addressed pressurized drums that are not designed with a means to vent the buildup of gasses.

Investigators determined that the waste material in the drums is contaminated with trichloroethylene (TCE). Inspectors inspected the drums on a weekly basis before they discovered the bulging conditions, but did not notice any bulging. Sixty drums are stored in the area where inspectors found the two bulged drums. Event response planners are evaluating the other drums in the storage unit to determine if they may become pressurized and will determine if

it is necessary to repackage the contents in drums that are self-venting or that can be readily vented.

NFS has reported other drum pressurization events in several Weekly Summaries. Following are some examples.

- Weekly Summary 97-39 reported that a 110-gallon over-pack drum containing a 55-gallon drum of nitric acid and a mixture of low-level radioactive waste ruptured in a waste storage facility at the Paducah Gaseous Diffusion Plant. The force of the rupture expelled the inner drum and spread its contents over a 400-square-foot area. (ORPS Report ORO--LMES-PGDPENVRES-1997-0008)

- Weekly Summary 97-03 reported that a hazardous waste worker was loosening a bolt on a 110-gallon drum ring at the Fernald Environmental Management Project when the lid blew off, striking the ceiling 14 feet above the worker and coming to rest on the floor 3 feet away. (ORPS Report OH-FN-FDF-FEMP-197-0003)

- Weekly Summary 96-42 reported on two events involving lids that were blown off pressurized drums when the locking rings were loosened. At the Paducah Plant, a waste sampler loosened a locking ring with a hammer, and the ring, the lid, and some contents blew out of the drum. At the Hanford Tank Farms, an operator loosened and moved the locking ring on a drum, and the lid flew 2 to 3 feet into the air and fell back on the drum. There was no radiological contamination or injuries in either occurrence. At Paducah, the drums contained degrading wood that generated methane gases; the drum at Hanford contained decaying weeds and soil that produced methane gases. (ORPS Reports ORO--LMES-PGDPENVRES-1996-0002 and RL--PHMC-TANKFARM-1996-0076)

- Weekly Summary 95-02 reported that workers at the Pacific Northwest Laboratory loosened a drum lid's clamp ring, and the lid forcibly dislodged from the drum and hit an overhead light fixture. Four, 120-ml bottles were thrown from the drum, and the contents spilled on the floor. Health physics personnel took radiological smears in the spill area and detected 150,000 dpm alpha and 5,000 dpm beta-gamma contamination. (ORPS Report RL--PNL-PNLBOPER-1995-0002)

These events underscore the importance of recognizing that many of the materials typically stored in drums, particularly organic materials, generate gasses and may pressurize the drum. Drum selection should take into account the possibility of gas generation and should incorporate a self-venting feature or provide for convenient manual venting if evidence of pressurization is observed. These events also underscore the importance of recognizing a pressurized drum and knowing the hazards that a pressurized drum presents to workers and the environment. In the recent Idaho event, personnel were aware of the hazards presented by pressurized drums and took appropriate actions to vent them. Personnel also need to be aware that new and empty drums can become pressurized. On May 17, 1995, at the Grand Junction Project Office, the lid on a new 55-gallon drum blew off when a radiation technician attempted to remove it. Investigators believed differences between ambient conditions at the locations where the drum was sealed and where the drum was opened caused the pressurization. There was no indication of pressurization. (Lessons Learned List Server Item Number 1995-AI-GEO-01)

In February 1993, NFS issued DOE/NS-0013, Safety Notice 93-1, "Fire, Explosion, and High-Pressure Hazards Associated with Waste Drums and Containers." This notice describes lessons learned on safe storage and handling of waste containers and drums. The notice specifically discusses handling, storing, venting, and opening containers suspected of being pressurized or containing flammable vapors. Safety Notice 93-1 can be obtained by contacting the ES&H Information Center, (800) 473-4375, or by writing to U.S. Department of Energy, ES&H Information Center, EH-72, 19901 Germantown Road, Germantown, MD 20874.

KEYWORDS: pressurized drum, safety

FUNCTIONAL AREAS: industrial safety, materials handling/storage

5. OPERATORS ACCIDENTALLY CUT SPENT FUEL DURING CROPPING OPERATION

On February 24 and 25, 1998, at the Savannah River L-Reactor Area, Basin Operations personnel accidentally cut fuel material while cropping spent fuel from a foreign research reactor. The fuel was aluminum-based, high-enriched uranium with aluminum cladding. The operators stopped the work and notified Basin Engineering personnel, who confirmed that the fuel had been cut. The facility manager stopped all fuel movements, and criticality engineers determined that the cut fuel was safe. The cropping operation is used to remove the non-fuel-bearing material from the fuel to facilitate bundling and storage of the irradiated fuel. Investigators determined that the fuel elements were already cropped before they arrived at the site and that reviews of the supplied documentation were inadequate. This event is significant because cutting fuel material can result in the spread of contamination from cutting fines and could cause a release of fission products. (ORPS Report SR--WSRC-REACL-1998-0004)

Operators performed the cropping procedure under 17 feet of water using a saw with adjustable stops. The stops allowed the operators to consistently cut the fuel to the same length. After the fuel was cropped, operators placed five fuel elements end-to-end in a 11-foot-long bundle for storage. Fuel owners are required to provide complete documentation of the fuel to Savannah River Site reviewers for approval. A half-size drawing of the fuel with geometry, dimensional information, and the location for cropping is provided with the documentation package.

During the documentation approval process reviewers determined that the fuel was already cropped, but the half-size drawing did not show the crop lines indicating where the fuel had been cropped. They contacted the fuel owner, who sent an 8-½ by 11-inch drawing showing the crop lines. The reviewers approved the fuel documentation and added the new drawing to the package. Investigators determined that three organizations (Basin Engineering, Operations, and Criticality Safety) were supposed to review all available documentation before work on the fuel began. However, in all three reviewing organizations, personnel reviewed only the half-sized drawing and did not review the documentation package with the additional drawing. Based on their review, Basin Engineering personnel assumed the fuel was not cropped and set the stops on the cropping saw accordingly. The first cut on the saw was satisfactory. However, when the operators turned the fuel around to cut the other end, they cut 2 cm into the fuel-bearing material. An operator observed a different color while cutting the fuel material and stopped the process. Although the procedure identified the crop lengths, it did not require the operators to determine or verify that they were not cutting into the fuel.

NFS has reported numerous events in the Weekly Summary involving inadequate documentation review in the work-planning process. Following are examples.

- Weekly Summary 98-07 reported that inadequate preparation and review of work documents at the Savannah River Site resulted in worker exposure to higher than expected contamination levels during decontamination and remediation activities. Radiological control technicians surveyed a laboratory following glovebox removal and discovered contamination levels up to 1,000,000 dpm alpha and 20,000 dpm beta-gamma from metal filing residue. Investigators determined that work planners did not adequately review the work documents and did not anticipate activity levels of this magnitude from the work. (ORPS Report SR--WSRC-ALABF-1998-0001)

- Weekly Summary 97-08 reported that a procedure inadequacy allowed a valve to remain open that affected the sparging of plutonium nitrate solution at the Rocky Flats Environmental Technology Site. The open valve decreased system vacuum and affected the sampling and movement of a solution that has criticality safety implications. Investigators determined that this occurrence was the result of an inadequate review of system drawings and a less-than-adequate walk-down of the system during development of the procedure. (ORPS Report RFO--KHLL-771OPS-1997-0009)

- Weekly Summary 96-14 reported that radiological control technicians at Savannah River detected radiation fields of 10 rem/hr during the transfer of radioactive waste water between two tanks. The radiation came from the receiving tank valve box where lead shielding around some pipes was removed during an earlier temporary modification. Investigators determined that an inadequate review of the modification by facility personnel resulted in an inadequate evaluation of the exposure potential for the missing shielding. (ORPS Report SR--WSRC-ITP-1996-0005)

This event underscores the importance of performing thorough reviews of all available documentation when planning work activities to ensure that radiological or other safety hazards are prevented. In this event none of the three reviewing organizations performed an adequate review of all supplied documentation. A thorough review would have identified that the fuel was already cropped.

KEYWORDS: documentation, fuel assembly, fuel handling, spent fuel, radiation protection, work planning

FUNCTIONAL AREAS: Work Planning, Radiation Protection